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ROOTING MEDIA FOR GROWING PINE SEEDLINGS IN HYDROPONIC CULTURE

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Summary

Rooting medium influences the growth and survival of Honduras pine in a hydroponic culture. Plants grew tallest in vermiculite, were of intermediate height in gravel and charcoal, and were shortest in mahogany sawdust. Root systems were longest and more ramified in vermiculite. Gravel did not offer satisfactory support. Initial survival was lowest in charcoal.

Resumen

En un cultivo hidropónico el medio en que arraigan los arbolitos del pino hondureño influye en su crecimiento y supervivencia. Las plantas crecieron más altas en vermiculita, las que crecieron en grava y carbón obtuvieron una altura intermedia y las que estaban en aserrín de caoba fueron las más pequeñas. Las raíces de las plantas en vermiculita resultaron las más largas y ramificadas. La grava no resultó satisfactoria como sostén. La supervivencia inicial más baja se obtuvo en el carbón.

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Demand for Honduras pine (Pinus caribaea Morelet var. hondurensis) planting stock now exceeds nursery production in Puerto Rico. The principal limiting factor has been the time and expense necessary to produce potted trees, which are used because bareroot seedlings and transplants have given erratic survival and slower initial growth.

Hydroponics may help to solve these and other problems of pine. Rapid nursery growth under optimum conditions in hydroponic culture would shorten the time from seed to plantable stock, and physiological conditioning by closely regulated culture may yield a plant which can better withstand bareroot planting.

Basic to studies in hydroponic culture is a rooting medium which provides satisfactory physical support and physiological growth condition.

The Experiment

A study of the use of four rooting media was carried out in 1963 in the nursery of the Institute of Tropical Forestry at Río Piedras, with seed imported from British Honduras.

The four rooting media tested were:

1. vermiculite
2. non-calcareous gravel
3. crushed, weathered charcoal
4. weathered mahogany sawdust

The degree of weathering of the charcoal and sawdust is unknown, except that both were exposed a minimum of four months.

Two asphalt-covered, galvanized metal tubs 50 cm square by 30 cm deep were used for each medium. Two centimeters of non-calcareous gravel were spread on the bottom to facilitate drainage. Above the gravel a 20-cm layer of the medium to be tested was placed. Finally, to avoid differences in surface temperature due to insolation, a 2.5 cm layer of vermiculite was spread on top of all media.

A common nutrient solution, used for all treatments, was made from a commercial powder with percentages of N-P-K of 7-16-19[1]. This solution was gradually increased in strength from 0 gm/liter to 3 gm/liter at 55 days. It remained at this nominal concentration until the experiment terminated, at 85 days. The original pH of the solutions was 6.3. Water lost through transpiration was replaced with tap water.

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[1] Briscoe, C.B., and R.P. Belanger, 1963. Effects in the nursery of irrigating seedlings with a nutrient solution. Carib. Forester 24:2 (in press).

The tubs were flooded from below to a depth of about 22 centimeters for 45 minutes at 4-hour intervals. When the pump was shut off, the solution from all tubs drained back to a common container to await the next cycle.

The seedlings used were transplanted into the experimental tubs at a spacing of 5 cm by 5 cm. Each tub contained 81 seedlings. Those seedlings which did not survive transplanting were replaced after 6 days.

The seedlings were successfully inoculated with mycorrhiza 7 days after being transplanted.

Results

The mortality of seedlings one week after transplanting showed that charcoal was a hostile medium, Table 1.

The cause or causes of death was not determined. Possibly it is linked with the alkalinity of the charcoal; the pH of the solution rose from 6.3 to 7.9 after circulating several times through the crushed charcoal. It was reduced to 6.3 by use of H_3PO_4.

Height was measured from the cotyledons to the tip of the tallest needle. The original height of all the transplants averaged 3.7 cm.

The minimum survival was 61; therefore, final heights of the largest 61 plants per treatment were measured for comparison after 85 days growth in the tubs.

The average height of trees in vermiculite was taller (significantly at the 99% level of confidence) than all others, and all treatment means differed significantly at the 95% level. These results indicate that the supporting medium does influence the growth of the plants. Furthermore, gravel --a common medium in hydroponic units-- was less suitable for rapid height growth than vermiculite.

The root systems of the plants grown in vermiculite were longer and more ramified than those grown in other media.

Gravel did not offer sufficient support. The space between pebbles was large enough to allow the seedlings to fall over as the wind blew them back and forth. All other treatments provided satisfactory support.

In the vermiculite tubs, algae and fungi grew on the surface and formed a mat which helped support the seedling stems. There was no evidence that this growth was harmful to the seedlings. No such mat was observed on other treatments.

There was no evidence that 3 gm/liter was a harmful concentration for pine.

Table 1.--Mortality percentage six days after transplanting

Medium	Block 1	Block 2
Charcoal	42	43
Sawdust	2	6
Gravel	5	2
Vermiculite	1	1

Table 2.--Heights of 61 tallest trees, 85 days after transplanting

Medium	Height
	cm
Vermiculite	11.5
Gravel	8.8
Charcoal	8.3
Sawdust	7.1